

AD-A040 297

HONEYWELL INC GOLDEN VALLEY MINN CERAMICS CENTER
PRODUCTION ENGINEERING MEASURE (PEM) MANUFACTURING METHODS AND --ETC(U)
JAN 77 W B HARRISON, L HILTNER, W KAMMEYER
46585

F/G 9/1

DAAB07-76-C-0008

NL

UNCLASSIFIED

| OF |

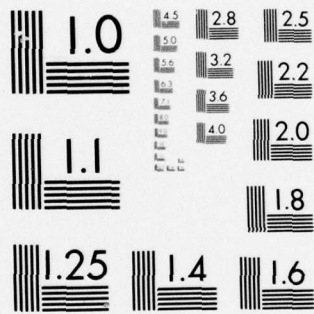
AD
A040297



END

DATE
FILMED

7-77



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD A 040297

SIXTH QUARTERLY PROGRESS REPORT
PRODUCTION ENGINEERING MEASURE (PEM)

MANUFACTURING METHODS AND TECHNIQUES
FOR PIEZOELECTRIC TRANSFORMERS

CONTRACT DAAB07-76-C-0008

October 14, 1976, to January 14, 1977

PLACED BY:
PRODUCTION DIVISION, PROCUREMENT AND
PRODUCTION DIRECTORATE, USAECOM
FORT MONMOUTH, NEW JERSEY

CONTRACTOR
HONEYWELL INC.
GOVERNMENT AND AERONAUTICAL PRODUCTS DIVISION
CERAMICS CENTER
GOLDEN VALLEY, MINNESOTA

DISTRIBUTION STATEMENT
UNCLASSIFIED: "Approval for public release; distribution unlimited"

AD No. ~~1~~
DDC FILE COPY



DISCLAIMER STATEMENT

"The findings in this report are not to be construed as official Department of the Army position unless so designated by other authorized documents."

DISPOSITION INSTRUCTIONS

"Destroy this report when it is no longer needed. Do not return it to the originator."

ACKNOWLEDGEMENT

"This project has been accomplished as part of the U. S. Army Manufacturing and Technology Program, which has as its objective the timely establishment of manufacturing processes, techniques or equipment to ensure the efficient production of current or future defense programs."

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (WHEN DATA ENTERED)

9 REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Sixth Quarterly Progress Report. no. 6, 14 Oct 76 - 14 Jan 77	2. GOV'T ACCESSION NUMBER	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (AND SUBTITLE) MANUFACTURING METHODS AND TECHNIQUES FOR PIEZOELECTRIC ENGINEERING MEASURE (PEM)	5. TYPE OF REPORT/PERIOD COVERED Quarterly October 14, 1976-January 14, 1977	6. PERFORMING ORG. REPORT NUMBER 46585 ✓
7. AUTHOR(S) William B./Harrison, h./Hiltner W./Kammeyer	8. CONTRACT OR GRANT NUMBER(S) DAAB07-76-C-0008 ✓	9. PERFORMING ORGANIZATION NAME/ADDRESS Honeywell Inc. Government and Aeronautical Products Division Ceramics Center Golden Valley, Minnesota 55422
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Project No. 2759525	11. CONTROLLING OFFICE NAME/ADDRESS Production Division, Procurement and Production Directorate, USAECOM, Fort Monmouth, New Jersey	12. REPORT DATE
13. NUMBER OF PAGES 26	14. MONITORING AGENCY NAME/ADDRESS (IF DIFFERENT FROM CONT. OFF.) 11 14 Jan 77 12 21p.	15. SECURITY CLASSIFICATION (OF THIS REPORT) Unclassified
16. DISTRIBUTION STATEMENT (OF THIS REPORT) Approval for public release; distribution unlimited.		15a. DECLASSIFICATION DOWNGRADING SCHEDULE
17. DISTRIBUTION STATEMENT (OF THE ABSTRACT ENTERED IN BLOCK 20, IF DIFFERENT FROM REPORT) 6 Production Engineering Measure (PEM) Manufacturing Methods and Techniques for Piezoelectric Transformers.		18. SUPPLEMENTARY NOTES
19. KEY WORDS (CONTINUE ON REVERSE SIDE IF NECESSARY AND IDENTIFY BY BLOCK NUMBER) Piezoelectric transformers Transformers Lead zirconate-lead titanate ceramics Night vision goggles Image intensifier tubes		
20. ABSTRACT (CONTINUE ON REVERSE SIDE IF NECESSARY AND IDENTIFY BY BLOCK NUMBER) The Sixth Quarterly Report for Contract DAAB07-76-C-0008 describes the progress and status of this program to establish a cost-effective production capability for 18mm and 25mm piezoelectric ceramic transformers. The construction status for the 30 confirmatory 18mm and 25mm PETs is reviewed in this report.		

HD-168 REV 11/74

SECURITY CLASSIFICATION OF THIS PAGE (WHEN DATA ENTERED)

UNCLASSIFIED
DATE 10/1/01 BY 1045
REASON FOR CLASSIFICATION

SIXTH QUARTERLY REPORT

CONTRACT NO.

DAAB07-76-C-0008
Manufacturing Methods and Techniques
for Piezoelectric Transformers

PERIOD COVERED:

October 14, 1976 to January 14, 1977

PREPARED BY:

W. Harrison
L. Hiltner
W. Kammeyer

OBJECT OF STUDY:

The objective of this contract is to establish a production capability for 18mm and 25mm piezoelectric ceramic transformers with all required manufacturing methods, test procedures and production tooling for high production rates. These transformers are to be used in conjunction with a power supply for operating night vision image intensifier tubes.

SIGN for	
NTIS	White Section <input checked="" type="checkbox"/>
DOC	Buff Section <input type="checkbox"/>
UNANNOUNCED	
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
Dist.	AVAIL. and/or SPECIAL
A	

DISTRIBUTION STATEMENT

UNCLASSIFIED: "Approval for public release, distribution unlimited"

ABSTRACT

The Sixth Quarterly Report for Contract DAAB07-76-C-0008 describes the progress and status of this program to establish a cost-effective production capability for 18mm and 25mm piezoelectric ceramic transformers. The construction status for the 30 confirmatory 18mm and 25mm PETs is reviewed in this report.

PURPOSE

This Production Engineering Measure (PEM) contract covers all of the tooling, test methods, package designs, mounting techniques, interconnection techniques and other manufacturing methods and techniques required for eventual production of 18mm and 25mm piezoelectric transformers. These units are to be used with a power supply to improve the performance and reduce cost for image intensifier tubes used in various night vision devices.

TABLE OF CONTENTS

Section		Page
	PURPOSE	v
I	APPROACH	1
II	PROCESS REVIEW	2
III	STATUS AND FUTURE WORK	7
	A. Task 1-6.	7
	B. Task 7 - Polarization Tooling	7
	C. Task 8-18	7
	D. Task 19 - Confirmatory Build	7
IV	CONCLUSIONS	10
V	RECOMMENDATIONS	11
VI	REPORTS	12
VII	IDENTIFICATION OF PERSONNEL	13
APPENDIX		
A	DISTRIBUTION LIST	A-1

LIST OF ILLUSTRATIONS

Figure		Page
1	30 kV Polarization Station	3
2	18 and 25mm Poling Fixture	5
3	Program Status Against Schedule	8

LIST OF TABLES

Table		Page
1	Operation Status	9

SECTION I APPROACH

Our approach to both the 18mm and 25mm PET designs, its advantages and the analytical method used to determine performance of these transformers, was discussed in the first quarterly report⁽¹⁾.

(1) First Quarterly Progress Report, Production Engineering Measures (PEM), Manufacturing Methods and Techniques for Piezoelectric Transformers, Contract Number DAAB07-76-C-0008, July 14, 1975, to October 14, 1975.

SECTION II

PROCESS REVIEW

All processing steps on this program have been documented previously⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾⁽⁵⁾ for the 18mm and 25mm PETs. Only minor differences are expected to be made in the confirmatory build process. Those that have been made are described below:

OP 120 Polarization

A. Materials

1. Peanut Oil

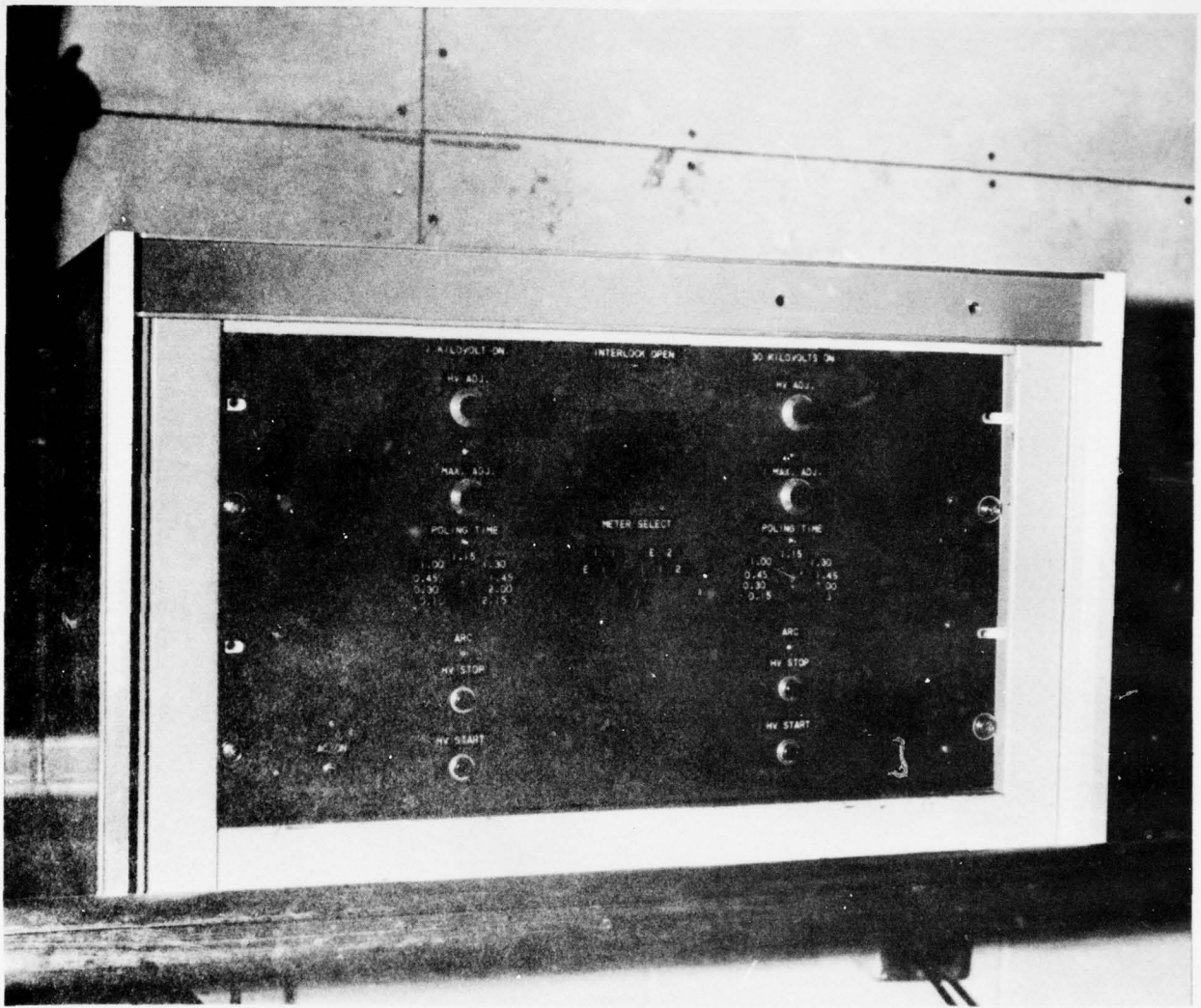
B. Tools and Fixtures

1. 30 kV polarization station (see Figure 1a)
2. Poling fixture (see Figure 2)
3. Chlorethane degreaser

C. Procedure

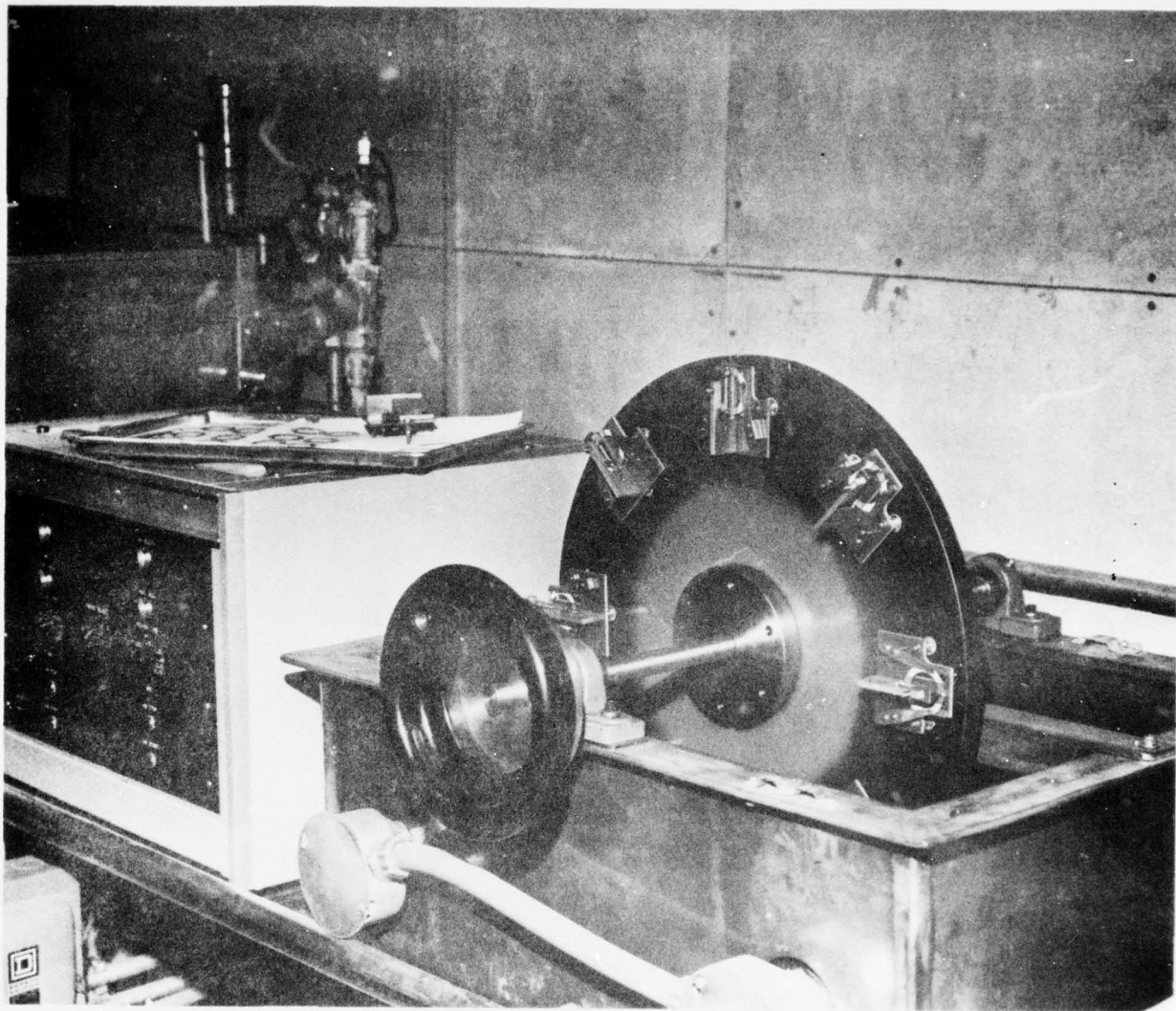
1. Place 18mm or 25mm elements in poling fixture with positive and negative leads of primary electrodes connected to external leads.
2. Rotate fixture in 165°C oil bath to next station. Voltage is applied to parts in oil.

-
- (2) Second Quarterly Progress Report, Production Engineering Measure (PEM) Manufacturing Methods and Techniques for Piezoelectric Transformers, Contract Number DAAB07-76-C-0008, October 14, 1975, to January 14, 1976.
 - (3) Third Quarterly Progress Report, Production Engineering Measure (PEM) Manufacturing Methods and Techniques for Piezoelectric Transformers, Contract Number DAAB07-76-C0008, January 14, 1976, to April 14, 1976.
 - (4) Fourth Quarterly Progress Report, Production Engineering Measure (PEM) Manufacturing Methods and Techniques for Piezoelectric Transformers, Contract Number DAAB07-76-C-0008, April 14, 1976, to July 14, 1976.
 - (5) Fifth Quarterly Progress Report, Production Engineering Measure (PEM) Manufacturing Methods and Techniques for Piezoelectric Transformers, Contract Number DAAB07-76-C-0008, July 14, 1976, to October 14, 1976.



a. 30 kV Polarization Controls

Figure 1. 30 kV Polarization Station



b. Rotary Poling Station

Figure 1. 30 kV Polarization Station (Concluded)

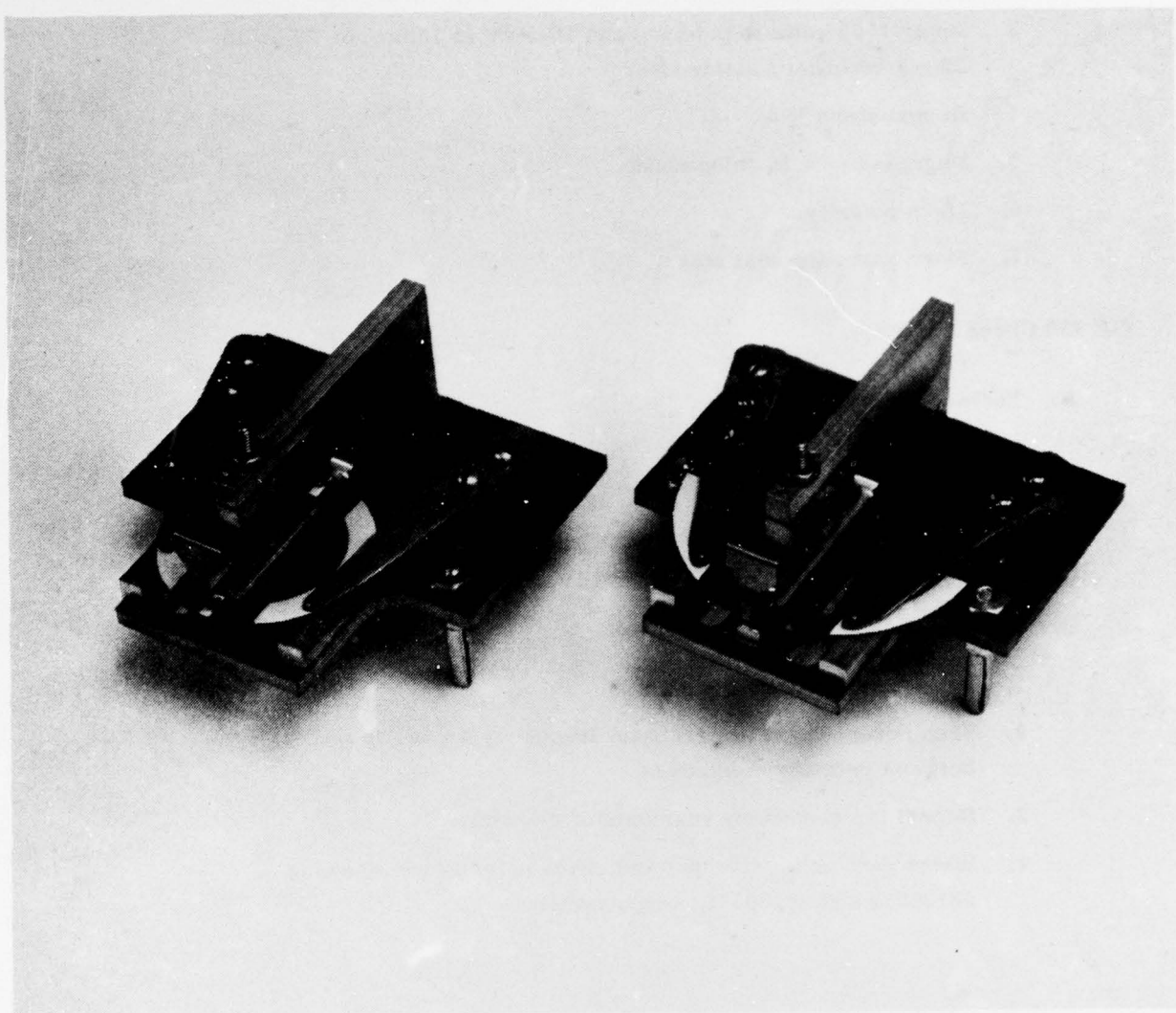


Figure 2. 18 and 25mm Poling Fixture

3. Apply 1500 volts to primary and 16.5 kV to 18mm, or 27 kV to 25mm secondary electrodes.
4. Repeat steps 1-3.
5. Degrease part in chlorethane.
6. Mark polarity.
7. Store parts for next stage.

OP 130 Check Polarity

A. Tools and Fixtures

1. d_{33} Checker
2. Sample Holder
3. Frequency Bridge

B. Procedure

1. Place part in sample holder
2. Scan resonant and antiresonant frequency for f_a , f_r and f_a/f_r between primary electrodes.
3. Repeat for secondary segments of element.
4. Insert part in d_{33} Checker and check polarity per drawing 28100510 and 28100571, respectively.

SECTION III

STATUS AND FUTURE WORK

This section describes the status of work against the various tasks outlined in Figure 3 that were active during this sixth quarter of the program. Approval to start the confirmatory build phase was requested October 7, 1976, and verbally received December 2, 1976.

A. TASK 1-6.

Work completed previously.

B. TASK 7 - POLARIZATION TOOLING

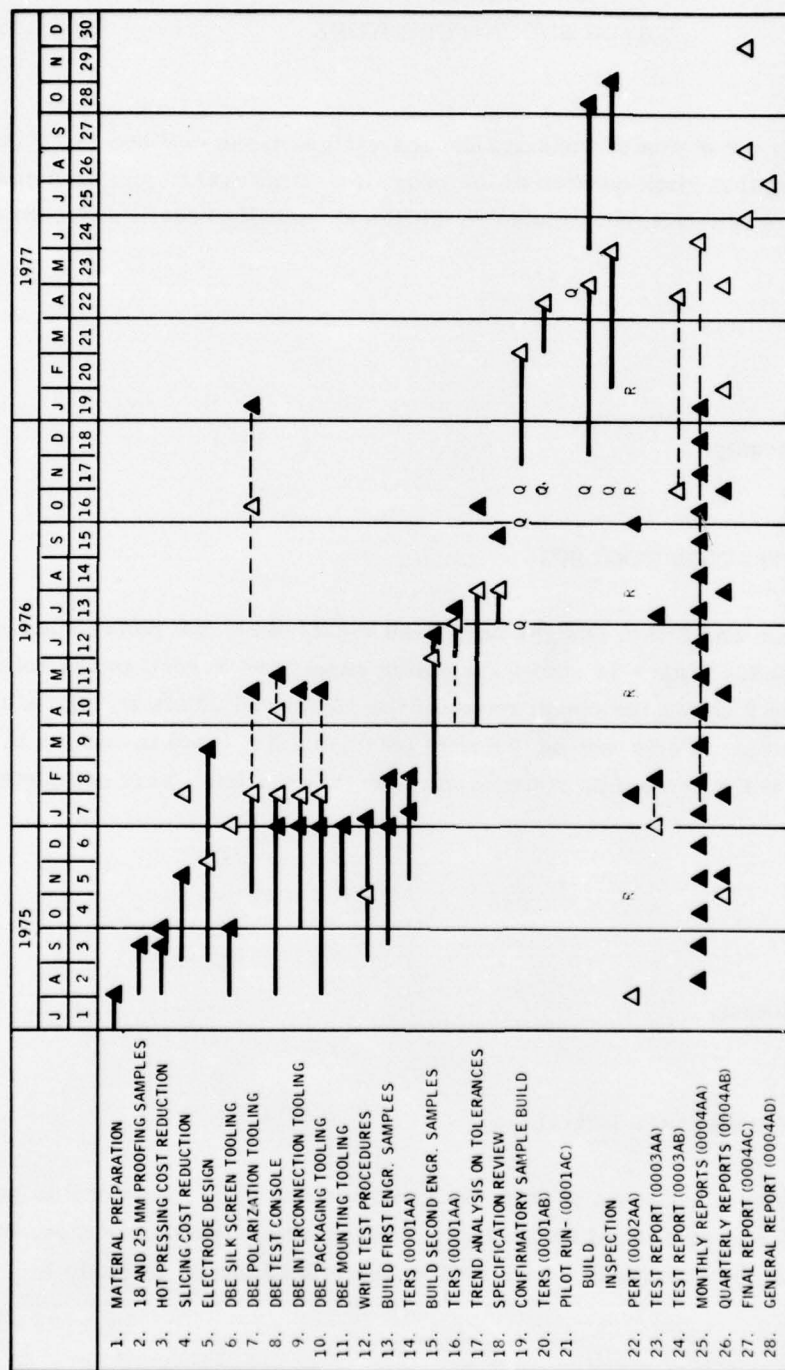
Now that both the 18mm and 25mm designs have been established, the poling station design has been completed. Figure 1a shows the poling supply and Figure 1b the rotary poling station. Figure 2 shows the construction of the 18mm and 25mm poling fixture used in the rotary station. Parts are individually poled, as discussed in Section II, at two levels of voltage at the two poling stations in the rotary station. This completes the work on this task.

C. TASK 8-18

Work completed previously.

D. TASK 19 - CONFIRMATORY BUILD

As indicated above, verbal approval to start the confirmatory build phase of this program was received 12/2/76 and confirmed on 12/22/76. The status of each operation, by operation number, for the 18mm and 25mm PET assemblies appears in Table I.



DBE DESIGN BUILD AND EVALUATE
 TERS TEST AND EVALUATION REVIEW AND SUBMIT
 R REVISE QUARTERLY AS REQUIRED
 Q REQUEST FOR APPROVAL TO START
 ▲ ORIGINAL OR REVISED COMPLETION DATES
 ▲ ACTUAL COMPLETION DATES

Figure 3. Program Status Against Schedule

The process for assembly of the 18mm units went quite smoothly; however, the 25mm elements assembly proved to be a major problem and quite time-consuming. The unproven, lower cost approach proposed for the confirmatory build whereby the top case was used as the bonding fixture was not workable. The case did not give adequate support to the first element inserted in the package and the setup time of the epoxy was too short. This resulted in cracking of the first element and poor control of the bond thickness between elements. Improvements in the thickness control of the bond was obtained by bonding three elements in an external bonding fixture and then bonding these to the first element in the package. However, of the 40 units made by this process, only 18 satisfactory units were obtained. Cracking of elements appeared to be the main cause of failure. Further efforts are being made to improve this process for the final build of 25mm confirmatory units.

Table 1. Operation Status

Description	Operation No.	18mm		25mm	
		Dwg. No.	Status	Dwg. No.	Status
Ceramic Elements	OP 010-130	28100576	Complete	28100571	Complete
Base Package Preparation	OP 140	28100578	Complete	28100568	Complete
Top Package Preparation	OP 140	28100577	Complete	28100569	Complete
Top Case Assembly	OP 150-160	28100560	Complete	28100561	18 Complete
Final Assembly	OP 170	28100560	Complete	28100561	12 Complete
Testing and Evaluation	OP 180	28100560	35 in Progress	28100561	9 in Progress

SECTION IV

CONCLUSIONS

The 18mm packaging process appears to be amenable to production approaches; however, additional efforts on the 25mm PET assembly approach are needed before it qualifies as a production assembly process.

SECTION V
RECOMMENDATIONS

Additional 25mm units need to be built by alternate approaches to determine means of improving the reliability of these confirmatory-produced PETs.

SECTION VI REPORTS

The fifth quarterly report on this program was approved and has been published and distributed during this report period. No other reports or publications have been made on this program.

SECTION VII
IDENTIFICATION OF PERSONNEL

During the sixth quarter of this program, the following personnel worked the indicated hours in their area of responsibility. No new professional persons, whose backgrounds have not been given previously⁽¹⁾⁽²⁾, were used.

<u>Individual</u>	<u>Responsibility</u>	<u>Hours</u>
W. B. Harrison*	Program Manager	26
W. H. Kammeyer*	Production Engineer, Ceramic Manufacture and PET Assembly	21
L. F. Hiltner*	Quality Engineer	40
M. P. Murphy	Ceramic Technician Ceramic Manufacturing	17
R. Ripley	Insp. PET Testing	14
R. Erickson	Drafting	3

* Backgrounds given in First and Second Quarterly Reports

APPENDIX A
DISTRIBUTION LIST

	Copies
Commander US Army Electronics Command ATTN: AMSEL-TL-BD (Dr. E. Schlam) Fort Monmouth, NJ 07703	1
Commander US Army Electronics Command ATTN: AMSEL-TL-BD (Mr. M. E. Crost) Fort Monmouth, NJ 07703	1
US Army Advanced Ballistic Missile Defense Agency ATTN: Mr. William O. Davies Director, Optics Development Division PO Box 1500 Huntsville, AL 38507	1
Commander US Army Electronics Command Night Vision Laboratory Systems Development Area ATTN: Mr. P. T. Deepel Fort Belvoir, VA 22060	1
Commander Frankford Arsenal ATTN: Mr. J. L. Helfrich, SARFA-DDS Philadelphia, PA 19137	1
Commander US Army Research Office Chief of Electronics Branch Engineering Science Division ATTN: Dr. Horst Wittmann Box CM, Duke Station, Duke University Durham, NC 27706	1
Naval Research Laboratory ATTN: Dr. D. Barbe, Code 5214 4555 Overlook Avenue, S. W. Washington, D. C. 20375	1
Commander US Army Electronics Command ATTN: DRSEL-TL-MD (Mr. Samuel DiVita) Fort Monmouth, NJ 07703	1
Commander, RADC ATTN: ISCE/Mr. M. Kesselman Griffiss AFB, NY 13440	1

	Copies
Lincoln Laboratory, MIT ATTN: Dr. Frank L. McNamara PO Box 73 Lexington, MA 02173	1
The Institute for Defense Analysis Science and Technology Division ATTN: Dr. Alvin D. Schnitzler 400 Army - Navy Drive Arlington, VA 22202	1
NASA Headquarters ATTN: Dr. Bernard Rubin, Code RES Washington, D. C. 20546	1
Director, National Security Agency ATTN: Mr. Paul S. Szczepanek, R-4 Fort George G. Mead, MD 20755	1
Director Night Vision Laboratory, USAECOM ATTN: AMSEL-NV-SD (Mr. Howard Kessler) Fort Belvoir, VA 22060	2 plus balance of undistributed copies
Director ATTN: AMSEL-RD-EV (Mr. Soo Young Shin) Fort Belvoir, VA 22060	1
Commander US Army Electronics Command ATTN: AMSEL-PP-I-PI-1 (Mr. Edward Mason) Fort Monmouth, NJ 07703	3
Commander US Army Production Equipment Agency ATTN: AMXPE-MT (Mr. C. E. McBurney) Rock Island, IL 61201	1
Commander US Army Electronics Command ATTN: AMSEL-RD-ET-2 Fort Monmouth, NJ 07703	1
The Institute for Defense Analysis Science and Technology Division ATTN: Mr. Lucien M. Biberman 400 Army - Navy Drive Arlington, VA 22202	1
Naval Electronics Systems Command ATTN: Mr. R. Wade ELEX-0151431 Washington, D. C. 20360	1
Defense Electronics Supply Center Directorate of Engrg. & Standardization DESC-ECS/N. A. Mauck 1507 Wilmington Pike Dayton, OH 45401	1

	Copies
Air Force Materials Laboratory Electronics Branch ATTN: Mrs. E. Tarrants Wright Patterson AFB, OH 45433	1
Commander Naval Electronics Laboratory Center Library San Diego, CA	1
ITT, Electron Tube Division ATTN: Mr. A. Hoover PO Box 7065 Roanoke, VA 24019	1
NI-TEC Night Technology Corporation ATTN: Mr. Ferd Fender 7426 Linder Avenue Skokie, IL 60076	1
RCA Main Plant, Electronics Components Division ATTN: Mr. Richard Mangen New Holland Avenue Lancaster, PA 17604	1
Varo, Incorporated 2203 Walnut Street Garland, TX 75040 ATTN: D. Lipke	2
Galileo Electro Optics Corporation Galileo Park Sturbridge, MA 01518 ATTN: J. Zaghi	2
Defense Documentation Center ATTN: DDC-IRS Cameron Station (Bldg. 5) Alexandria, VA 22314	12
Director, Electro-Optical Device Laboratory Bell Telephone Laboratories, Incorporated ATTN: Dr. Eugene I. Gordon Murray Hill, NJ 07974	1
Westinghouse Advanced Technology Laboratory ATTN: Dr. James A. Hall 3525 PO Box 1521 Baltimore, Maryland 21203	1
Advisory Group on Electron Devices ATTN: Working Group on Special Devices 201 Varick Street New York, NY 10014	2

	Copies
Xerox Corporation Palo Alto Research Center ATTN: Dr. Benjamin Kazan 3180 Porter Drive Palo Alto, CA 93404	1
General Electric Company Corporate Research & Development ATTN: Dr. Rowland W. Redington PO Box 8 Schenectady, NY 12301	1
RCA Electronic Components ATTN: Dr. Ralph E. Simon New Holland Pike Lancaster, PA 17603	1
Stanford University ATTN: Dr. William E. Spicer Department of Electrical Engineering Stanford, CT 93405	1
Massachusetts Institute of Technology ATTN: Dr. Robert Rediker Bldg. 13-3050 Cambridge, MA 02139	1
Litton Industries 960 Industrial Road San Carlos, CA 94070 ATTN: B. Bedford	1
Channel Products Incorporated 16722 Park Circle Drive, West Chargin Falls, OH ATTN: Mr. D. Berlincount	1
Erie Technological Products of Canada, Ltd 5 Fraser Avenue Trenton Ontario, Canada ATTN: P. Ransom	1
Venus Scientific 399 Smith Street Farmingdale, NY 11735 ATTN: F. Galluppi	1
Vernitron Piezoelectric Division 232 Fobes Road Bedford, OH 44146 Attn: G. Howatt	1
L&K Industries 3579 Merrick Road Seaford, Long Island, NY 11783	1

Gulton Industries
Piezo Products Division
Box 4300
Fullerton, CA 92634
ATTN: D. Herzfeld

Copies

1

K&M Electronics
59 Interstate Drive
West Springfield, MA 01089

1